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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/708,381	02/27/2004	Xiangdong Chen	FIS920030367US1	2380

23389 7590 01/25/2006

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EXAMINER

SOFOCLEOUS, ALEXANDER

ART UNIT PAPER NUMBER

2824

DATE MAILED: 01/25/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/708,381

Applicant(s)

CHEN ET AL.

Examiner

Alexander Sofocleous

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 December 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) 9-14, 19-20 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 15-18 is/are allowed.
- 6) ☒ Claim(s) 1, 2 and 6-8 is/are rejected.
- 7) ☐ Claim(s) 3-5 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 2/27/2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>5/25/2004</u> . | 6) <input checked="" type="checkbox"/> Other: <u>search history</u> . |

DETAILED ACTION

1. This action is responsive to the following communications: the Response to Election/Restriction filed December 28, 2005.
2. Claims 1-20 are pending in the case. Applicant elected claims 1-8 and 15-18. Claims 9-14 and 19-20 are withdrawn from consideration. Claims 1 and 15 are independent claims.

Information Disclosure Statement

3. Two document numbers have been crossed-through on Applicant's IDS submitted June 25, 2004 because the mailroom stamp covers portions of the respective document number. Examiner has considered and added to Form 892 the following document numbers: U.S. Patent Publication 2003/0224573 and U.S. Patent 6,269,280.
4. It is noted that there is a discrepancy on the 1449 filed on June 25, 2004 with a Patent Application Publication Number. Examiner assumes that the applicant intended to cite U.S. Patent Application Publication 2003/~~01~~55609 instead of 2003/~~10~~55609. Therefore, the examiner has crossed through 2003/~~10~~55609 and not considered 2003/~~10~~55609 in favor of 2003/~~01~~55609, which has been cited on form PTO-892.

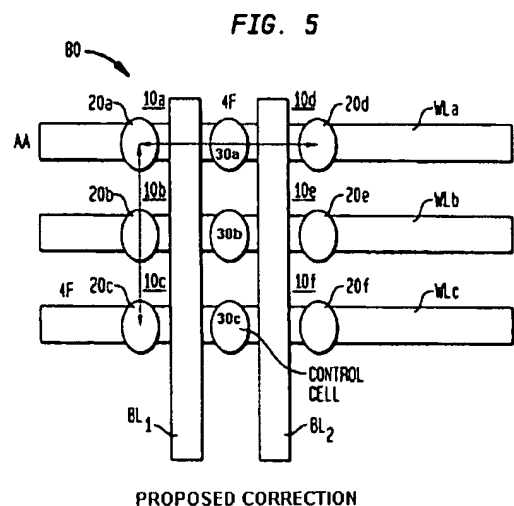
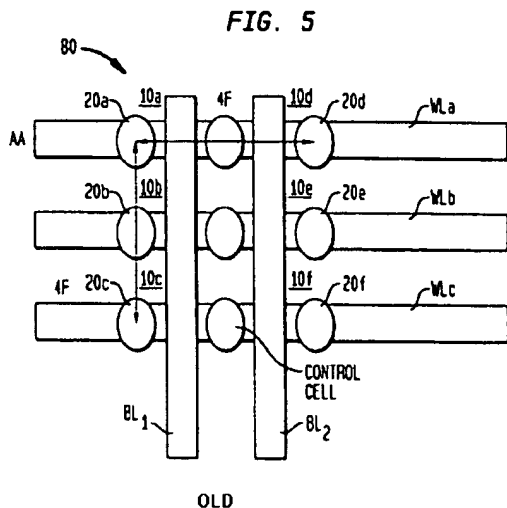
Drawings

5. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the

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description: 30a, 30b, and 30c (see Fig. 5 with respect to paragraph 0025).

Examiner suggests adding 30a, 30b, and 30c to Figure 5 (see proposed correction below).



Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

6. The disclosure is objected to because of the following informalities:

Paragraph 0015 states, "the DRAM structure 10 including storage cell MOSFET and control cell MOSFETs 20,30..." For clarity purposes, Examiner suggests restating as --the DRAM structure 10 including storage cell MOSFET 20 and control cell MOSFET 30--; or, restating as --the DRAM structure 10 including storage cell and control cell MOSFETs 20, 30--. There are several other locations that require similar restating for clarity purposes.

Paragraph 0014 and 0015 indicate that storage cell is 20. Paragraph 0016 and 0017 indicate that control cell is 20. Examiner assumes that Applicant intended for storage cell to be 20 and control cell to be 30.

Paragraph 0016 indicates, "the p-well is connected at ***negative voltage such as 0.5V.***"

Examiner encourages Applicant to carefully review the specification and make corrections accordingly.

Appropriate correction is required.

Claim Objections

7. Claim 1 is objected to because it recites the limitation "said first buried strap." There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 2, 6, and 7 are rejected under 35 U.S.C. 102(e) as being anticipated by Chang et al. (U.S. Patent Application Publication 2005/0045936).

Regarding independent claim 1, Chang et al. show a deep trench capacitor (Fig. 4 [C₁]) in a semiconductor substrate (Fig. 4 [40]).

Chang et al. show a storage cell including a vertical pass transistor (Fig. 4 [T₁ <not shown>]; see Fig. 5 [T₁] with respect to paragraph 0021) having source and drain regions (Fig. 4 [BS₁, S/D]) formed in a p-well (Fig. 4 [40]), said drain region (Fig. 4 [BS₁]) formed by a diffusion in said p-well (Fig. 4 [40]) outside said deep trench capacitor (Fig. 4 [C₁]) adjacent said first buried strap (Fig. 4 [BS₁]) to conduct voltage to said trench capacitor (see paragraph 0021).

Chang et al. show a control cell for controlling the threshold voltage of vertical pass transistor (Fig. 4 [T₁]) according to a gate (Fig. 4 [GC₂]) connecting a second buried strap (Fig. 4 [BS₂]) and diffusion region (Fig. 4 [S/D]) formed in the p-well region (Fig. 4 [40]).

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Regarding dependent claim 2, Chang et al. show the voltage of a gate (Fig. 4 [GC₂]) connecting a second buried strap (Fig. 4 [BS₂]) and diffusion region (Fig. 4 [S/D]) further controls the conductive state of the vertical pass transistor (Fig. 4 [T₁]), said gate voltage comprising a wordline (Fig. 5 [GC₁, GC₂]) voltage controlling access to data stored in said deep trench capacitor (Fig. 4 [C₁]) via said vertical pass transistor (Fig. 4 [T₁]).

Regarding dependent claim 6, Chang et al. show a bitline (Fig. 4 [BL₁ to BC]) voltage to be stored in said DRAM cell (Fig. 4) in a write operation is connected with a source (Fig. 4 [S/D]) of said vertical pass transistor (Fig. 4 [T₁]).

Regarding dependent claim 7, Chang et al. show said drain (Fig. 4 [BS₁]) of said vertical pass transistor (Fig. 4 [T₁]) is formed by diffusion at said first buried strap (Fig. 4 [BS₁]).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chang et al. (U.S. Patent Application Publication 2005/0045936).

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Chang et al. show the cells to be connected by the same bit line (and a word line pair; Fig. 5), which differs from presently claimed invention's connecting the cells by the same word line (and a bit line pair).

However, it is commonly known to those of ordinary skill in the art of twin cell technology to connect the same word line to the gates of both cells.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to share the same word line with the two cells for the purpose of providing accessing means to the cells by use of a common word line and a bit line pair.

Allowable Subject Matter

10. **Claims 3-5 objected to as being dependent upon a rejected base claim**, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

11. **Claims 15-18 allowed.**

12. The following is a statement of reasons for the indication of allowable subject matter:

With respect to dependent claim 3, there is no teaching or suggestion in the prior art to the second buried strap region and diffusion region formed in the p-well of the control cell being at a lower depth than the first buried strap region and diffusion region formed in the p-well of the storage cell.

With respect to independent claim 15, there is no teaching or suggestion in the prior art to providing two deep trenches: one deep trench including a vertical storage cell and a deep trench capacitor and the other deep trench including a vertical control cell for controlling the threshold voltage of the storage cell by applying a voltage to the common conductor connecting the gate of the storage cell and control cell such that the voltage enables pinch-off resulting in the floating condition of the p-well decreases the threshold voltage when the storage cell is in an on-state or resulting in an increased gate over-drive and drive current when the storage cell is in an off-state.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: Radens et al. (U.S. Patent 6,437,388), and Beintner et al. (U.S. Patent 6,667,504).

Radens et al. and Beintner et al. disclose memory cell structures with a deep trench capacitor and vertical transistor and a first and second buried strap.

When responding to this office action, applicants are advised to provide the examiner with the line numbers and page numbers in the application and/or references cited to assist the examiner in locating appropriate paragraphs.

A shortened statutory period for response to this action is set to expire three months and zero days from the date of this letter. Failure to respond within the period for response will cause this application to become abandoned (see MPEP 710.02(b)).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alexander Sofocleous whose telephone number is 571-272-0635. The examiner can normally be reached on 7:00am - 4pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Elms can be reached on 571-272-1869. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

AGS

A handwritten signature in black ink, appearing to read 'R. Elms', with a date '1/23/06' written below it.

RICHARD ELMS
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800